BD

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : A61B 17/39

A1

(11) International Publication Number: WO 93/13719

(43) International Publication Date: 22 July 1993 (22.07.93)

(21) International Application Number: PCT/US93/00443

(22) International Filing Date: 15 January 1993 (15.01.93)

(30) Priority data:
821,753 15 January 1992 (15.01.92) US

(81) Designated States: AU, CA, JP, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

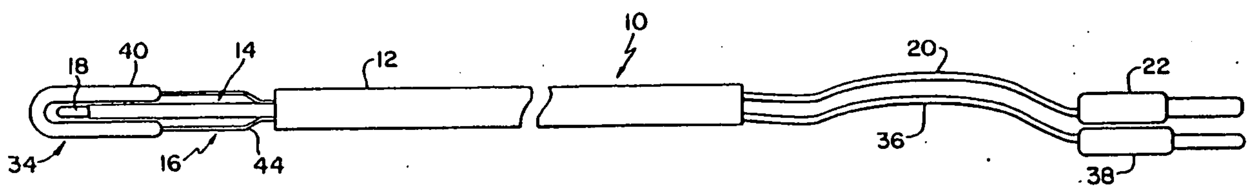
Published
With international search report.

(71) Applicant: BEACON LABORATORIES, INC. [US/US]; 2150 West 6th Avenue, Unit P, Broomfield, CO 80020 (US).

(72) Inventors: FLEENOR, Richard, P. ; 5765 South Monaco Street, Englewood, CO 80111 (US). BROMLEY, Robert, L. ; 892 Larkspur Court, Louisville, CO 80027 (US).

(74) Agents: MARSH, Thomas, R. et al.; Sheridan Ross & McIntosh, 1700 Lincoln Street, 35th Floor, Denver, CO 80203 (US).

(54) Title: BIPOLAR ELECTROSURGICAL INSTRUMENT



(57) Abstract

A bipolar electrosurgical apparatus (10) is provided which is suitable for laparoscopic applications. The apparatus (10) comprises an active electrode (18) and a current return electrode shoe (34). A spring (44) or other resilient member urges the shoe (34) into tissue contact when the active electrode (18) is positioned for surgery. The apparatus (10) is capable of functioning in a cut and a coagulation mode.

08

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	FR	France	MR	Mauritania
AU	Australia	GA	Gabon	MW	Malawi
BB	Barbados	GB	United Kingdom	NL	Netherlands
BE	Belgium	GN	Guinea	NO	Norway
BF	Burkina Faso	GR	Greece	NZ	New Zealand
BG	Bulgaria	HU	Hungary	PL	Poland
BJ	Benin	IE	Ireland	PT	Portugal
BR	Brazil	IT	Italy	RO	Romania
CA	Canada	JP	Japan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SK	Slovak Republic
CI	Côte d'Ivoire	LI	Liechtenstein	SN	Senegal
CM	Cameroon	LK	Sri Lanka	SU	Soviet Union
CS	Czechoslovakia	LU	Luxembourg	TD	Chad
CZ	Czech Republic	MC	Monaco	TG	Togo
DE	Germany	MG	Madagascar	UA	Ukraine
DK	Denmark	ML	Mali	US	United States of America
ES	Spain	MN	Mongolia	VN	Viet Nam
FI	Finland				

BIPOLAR ELECTROSURGICAL INSTRUMENT

FIELD OF THE INVENTION

This invention relates generally to electrosurgical instruments and, in particular, to a bipolar electrosurgical cutting/coagulating instrument particularly adaptable for use in constricted areas.

BACKGROUND OF THE INVENTION

Electrosurgery involves the use of an RF signal to produce electrosurgical effects, e.g., to cut and/or coagulate tissue. In conventional monopolar electrosurgery, an active electrode is contacted or positioned in close proximity to the tissue to be treated and a current return means (i.e. a pad) is positioned in contact with the patient to complete the circuit. Near the tip of the active electrode, the current is concentrated through a small area of tissue to provide a current density sufficient for cutting or coagulation. The current return means maintains a relatively large area of tissue contact to avoid tissue damage. If the contact surface of the current return means is too small, the current density may result in tissue damage.

In recent years, bipolar instruments have been used in certain electrosurgical applications. Bipolar instruments include a pair of closely spaced electrodes of opposite polarity, thereby eliminating the need for a remotely located current return means. It is an advantage of bipolar electrosurgical instruments that current flow

is substantially restricted to a small area between the electrodes. Bipolar instruments thereby reduce the likelihood of current damage due to high local current densities or current flow through highly sensitive tissues. Thus, bipolar instruments are advantageously employed in applications such as neurosurgery where the adjacent tissue may be particularly susceptible to damage. Further ease-of-use advantages can be readily appreciated since bipolar instruments do not entail interconnection of a remotely located current return means.

Despite these advantages, bipolar instruments have suffered certain limitations. For example, certain bipolar instruments are not unitary, i.e., the electrodes are mounted on separate support structures. Surgeons using such instruments commonly operate one electrode with each hand. Such instruments, therefore, have the disadvantage that the surgeon may be left without a free hand during surgery. In addition, the use of two separate support structures may crowd the surgical site and limit the surgeon's view. Such instruments are also difficult to use in constricted areas and may therefore necessitate larger incisions.

Another limitation of known bipolar instruments is that such instruments may fail to reliably maintain electrode/tissue contact during surgery. In some known bipolar instruments, both of the electrodes are rigidly interconnected to a single support structure such that substantially constant spacing is maintained between the

electrodes. When such instruments are used in an area of irregular tissue topography, one or both of the electrodes may occasionally lose contact with the tissue due to the inability to move the electrodes independently, resulting in unsatisfactory instrument performance.

Similarly, certain bipolar instruments have been limited due to the inability to easily and adequately adjust the cutting depth of such instruments during surgery. For example, one type of bipolar instrument employs a single cutting electrode and a second current return means positioned a substantially fixed distance rearwardly of the cutting electrode. In practice, a surgeon's ability to control the cutting depth of such instruments is hampered due to the inability to easily vary the distance between the cutting electrode and the current return means during surgery.

In addition, known bipolar instruments have generally not been adapted for use in both cut and coagulation modes. The electrosurgical effect achieved can be varied by changing the signal provided by an electrosurgical generator. Generally, a continuous sinusoidal signal waveform is used for cutting while an interrupted waveform is used for coagulation. Presently, bipolar pencils are principally employed to coagulate using the interrupted coagulation signals. It is therefore common for surgeons to use separate instruments for cutting and coagulation, resulting in time consuming double handling during surgery.

SUMMARY OF THE INVENTION

Accordingly, objectives of the present invention include the following.

The provision of a bipolar electrosurgical instrument wherein the electrodes are mounted on a support structure for relative movement therebetween.

The provision of a bipolar electrosurgical instrument wherein the return electrode reliably maintains adequate tissue contact during surgery.

The provision of a bipolar electrosurgical instrument wherein the return electrode can maintain tissue contact even in areas of irregular tissue topography.

The provision of bipolar electrosurgical instrument wherein the return electrode is resiliently urged into contact with tissue when the active electrode is positioned for surgery.

The provision of a bipolar electrosurgical instrument wherein the cutting depth can be easily and adequately controlled during surgery.

The provision of a bipolar electrosurgical instrument, including an active electrode and a current return electrode, wherein electrosurgical effects are substantially limited to an area adjacent to the active electrode.

The provision of a bipolar electrosurgical instrument which is suitable for use in constricted areas, e.g., transurethral and laparoscopic applications.

The provision of a bipolar electrosurgical instrument which is capable of functioning in a cut and in a coagulation mode for certain applications.

The provision of a bipolar electrosurgical instrument which is adapted to receive signals from the outlets of electrosurgical generators commonly associated with monopolar instruments.

Additional objectives and corresponding advantages will be apparent to those skilled in the art.

According to an embodiment of the present invention, an electrosurgical instrument is provided. In one aspect, the instrument comprises first and second electrode assemblies. One of the first and second assemblies may include an active electrode for cutting and/or coagulating tissue and the other assembly may include a current return electrode. The first and second electrode assemblies are mounted on a support structure for relative movement therebetween during surgery. Preferably, a biasing member is interposed between the first and second assemblies such that one of the assemblies is urged into contact with the tissue when the other assembly is positioned for surgery. The instrument can include a signal source capable of providing signals sufficient for cutting and/or coagulating tissue.

According to another aspect of the present invention, an electrosurgical instrument comprises a housing interconnected to first and second electrode assemblies for applying an electrical current to tissue. A biasing

mechanism is interposed between the first and second assemblies whereby the distance between the assemblies can be changed by varying the pressure with which the instrument is urged against tissue. The housing may include an elongated tube for laparoscopic applications. The first assembly may include a tissue contact surface which defines a substantially planar interface with the tissue during surgery, and the second assembly may be transversely movable relative to the interface.

According to a further aspect of the present invention, a method for use in electrosurgery is provided. The method includes the steps of positioning an instrument including first and second electrode assemblies at a surgical site, contacting the first assembly with tissue, and moving the second assembly relative to the first assembly to position the second assembly for surgery. Preferably, the first assembly comprises a current return electrode and the second assembly comprises an electrode for cutting or coagulating tissue. The method may also include the step of varying a cutting depth of the instrument during surgery by moving the second assembly relative to the first assembly.

DESCRIPTION OF THE DRAWINGS

Fig. 1a is a top of an electrosurgical apparatus constructed in accordance with an embodiment of the present invention;

Fig. 1b is a side cross-sectional view of the apparatus of Fig. 1a in a deflected position;

Fig. 1c is a side cross-sectional view of the apparatus of Fig. 1a in a relaxed position;

Fig. 2 is a perspective view of the apparatus of Fig. 1 interconnected with an electrosurgical generator;

Fig. 3a is a top view of an electrosurgical apparatus constructed in accordance with an alternative embodiment of the present invention;

Fig. 3b is a side cross-sectional view of the apparatus of Fig. 3a;

Fig. 4a is a top view of an electrosurgical apparatus constructed in accordance with an alternative embodiment of the present invention; and

Fig. 4b is a side cross-sectional view of the apparatus of Fig. 4a.

DETAILED DESCRIPTION OF THE INVENTION

In Figs. 1-2, like items are identified by like and corresponding numerals for ease of reference. Referring to Figs. 1a-1c, a bipolar electrosurgical apparatus constructed in accordance with an embodiment of the present invention is generally identified by the reference numeral 10. Figs. 1a-1c show a top view of the apparatus 10 (Fig. 1a), a side view of the apparatus 10 in a deflected position (Fig. 1b), and a side view of the apparatus 10 in a relaxed position (Fig. 1c).

The apparatus 10 comprises a longitudinal apparatus housing 12 which is interconnected to an active electrode assembly 14 and a current return electrode assembly 16. The housing 12 may be of molded plastic construction and may include a portion which is contoured for optimal handling by a user. In the illustrated embodiment, the housing comprises an elongated tube having an outside diameter selected to allow the housing 16 to be at least partially inserted through an access cannula for laparoscopic surgery.

The active electrode assembly 14 includes an active electrode 18 and signal supply wire 20 which terminates in standard plug 22 for electrically interconnecting the electrode 18 to a standard electrosurgical generator 24 (Fig. 2). It will be appreciated that the plug 22 can be of a type suitable for interconnection to the generator outlet normally utilized by monopolar instruments. The electrode 18 may be of various configurations depending, for example, on the intended application. Thus, the illustrated electrode 18 can be employed for localized cutting and/or coagulating. A so-called hoop electrode such as shown in Figs. 3a and 3b may be preferred to remove blockage from passageways, e.g., in transurethral surgery. Similarly, a generally blade-shaped electrode such as shown in Figs. 4a and 4b may be preferred for making longitudinal incisions.

As shown in Figs. 1a-1c, the electrode 18 is generally hook-shaped having a longitudinal portion 26 and

a transverse portion 28. A relatively small end surface 30 is thereby provided so that the electrosurgical effects are restricted to a small tissue area. Insulation 31 is provided about a portion of electrode 18 to reduce the likelihood of shunting or short circuits between electrode 18 and return assembly 16. The electrode 18 may be removably interconnected to the wire 20 by way of a socket 32 to facilitate replacement of the electrode 18.

The return electrode assembly 16 comprises an electrode shoe 34 and a current return wire 36 which terminates in standard plug 38 for electrically interconnecting shoe 34 to a standard electrosurgical generator 24 (Fig. 2). The shoe 34 may be removably interconnected to wire 36 by way of socket 37. The shoe 34, which is partially covered by insulation 40 to prevent shunts or short circuits, includes an exposed tissue contact surface 42. In the illustrated embodiment, the surface 42 is generally "U" shaped and is disposed around the electrode 18 to enhance tissue contact, particularly in areas of irregular tissue topography.

In order to achieve satisfactory performance and avoid tissue damage, shoe 34 must maintain an adequate area of tissue contact. It will be understood that the area of tissue contact necessary to avoid harmful current densities will depend on a number of factors including the power supplied to apparatus 10 and the rate of movement of the shoe 34. The apparatus 10 can be advantageously employed in certain low power (10 to 35 watts), narrow

surgical applications, e.g., laparoscopic surgery. In such a setting, the shoe 34 should maintain an area of tissue contact at least three times that of the active electrode 18. Such an area of tissue contact performs adequately under conditions wherein the shoe 34 is frequently moved, avoids excessive obstruction of the surgeon's view and allows the apparatus 10 to be sized appropriately for laparoscopic applications. Of course, the required area of tissue contact will be greater for higher power applications and for applications where the shoe 34 is moved infrequently.

The electrode 18 and the shoe 34 are interconnected to the housing 12 in a manner such that the shoe 34 and contact surface 42 are urged into tissue contact when the electrode 18 is positioned for surgery. For example, a spring or other resilient member may be disposed between the assemblies 14 and 16 so that the shoe 34 is urged into tissue contact when the electrode 18 is positioned for surgery. In the illustrated embodiment, the shoe 34 is interconnected to the housing 12 by way of an integral or interconnected conductive leaf spring 34 (which additionally serves to electrically interconnect shoe 34 and wire 36). The spring 34 allows for relative movement between the active electrode 18 and electrode shoe 34. It will be appreciated that many other configurations and assemblies for maintaining return electrode/tissue contact are possible according to the present invention. For example, shoe 34 could be pivotally mounted on housing 12

and a coil spring or other resilient member could be disposed between the electrode 18 and shoe 34 to urge the electrode 18 and shoe 34 laterally apart. Similarly, for applications wherein the return electrode is longitudinally retracted when the active electrode is positioned for surgery, a resilient member could be provided to urge the return electrode towards a longitudinally extended position.

Referring to Fig. 2, standard plug 22 of signal supply wire 20 and standard plug 38 of current return wire 36 are interconnected with standard electrosurgical generator 24 for use with apparatus 10. It is an advantage of the present invention that the apparatus 10 can be interconnected to the generator outlet normally utilized by monopolar instruments. By way of example only, electrosurgical generator 24 may be any of the following or equivalents thereof: the "ACC 450," "ACC 470" or "MCC 350" of Erbe Electro Medical Equipment; the "FORCE 2" or "FORCE 4" generators of Vallylab, Inc.; the "EMS 3000," "EMS 4400," or "EMS 5000" of Bard Electro Medical Systems, Inc., the "X10" of Bovi, Inc.; the "9000" by Concept, Inc.; or the "EXCALIBER," "MH 380" or "MH 450" of Aspen Laboratories, Inc. These products are designed to receive standard plugs 22 and 38, and can be preset to selectively provide at least an appropriate first predetermined RF signal for tissue cutting and an appropriate second predetermined RF signal for coagulation. Again, caution must be exercised in matching a generator or generator

setting with a particular instrument and application as the required area of return electrode/tissue contact depends on factors including the power supplied to the instrument and rate of return electrode movement.

The apparatus 10 can be employed in laparoscopic surgery as follows. First, the surgeon makes a small incision to allow insertion of an access cannula. The access cannula, which may be provided at its leading edge with a trocar, is then inserted into the patient to provide access to the surgical site. Thereafter, the electrode 18 and shoe 34 are inserted through the access cannula to the surgical site. The surgeon positions the electrode 18 for surgery with the aid of an optical system. To initiate a surgical procedure, the surgeon moves the electrode 18 towards the tissue to be treated, or downwardly as viewed in Figs. 1b and 1c. The shoe 34, which contacts the tissue first, deflects as shown in Fig. 1b to allow the electrode 18 to be positioned for surgery. In a cutting mode, the cutting depth can be adjusted by simply pressing the instrument harder against the tissue such that greater deflection is achieved. During surgery, the spring 44 urges the shoe 34 against the tissue so that adequate tissue contact is maintained. It will be appreciated that shoe 34 must maintain a sufficient area of tissue contact to function in a cut or coagulation mode substantially without cutting or burning of the tissue adjacent to the shoe 34.

Referring to Figs. 3a and 3b, top and side views, respectively, of apparatus 46 constructed in accordance with an alternative embodiment of the present invention are shown. The apparatus 46 is provided with a so-called hoop electrode 48, such as is commonly employed for transurethral surgery. The electrode 48 is partially covered by insulation 50 to prevent shunts or short circuits between the hoop electrode 48 and current return electrode shoe 52. Similarly, insulation 54 is provided on a top portion of the shoe 52 to prevent shunts or short circuits. A bottom surface 56 of the shoe 52 is exposed to provide a tissue contact area.

When the electrode 48 is in a retracted position (shown), the electrode 48 rests against an insulation pad 58 provided on the bottom surface 56 of current return electrode shoe 52. As the electrode 48 is positioned for surgery, shoe 52 is deflected such that electrode 48 pulls away from pad 58. The bottom surface 56 of the shoe 52 is urged into contact with tissue during surgery by spring 60.

Referring to Figs. 4a and 4b, top and side views, respectively, of a apparatus constructed in accordance with a further alternative embodiment of the present invention are shown. The apparatus 62 includes a generally blade-shaped active electrode 64. Again, insulation 66 is provided about a portion of the electrode to reduce the likelihood of shunts or short circuits between the electrode 64 and the current return electrode shoe 68.

Insulation 70 is also provided on a top portion of the shoe 68 to reduce the likelihood of shunts or short circuits. However, a bottom surface 72 of the shoe 68 is exposed for tissue contact. The shoe 68 and bottom surface 72 are generally "U" shaped and are disposed around the electrode 64 to enhance tissue contact, particularly in areas of irregular tissue topography. In addition, a front portion of the shoe 68 may be slanted upwardly, as shown, to enhance tissue contact when the apparatus 62 is employed in an angled position as is common for making incisions. As the electrode 64 is positioned for surgery, the shoe 68 is deflected such that the electrode 64 extends therethrough. Spring 76 urges the bottom surface 72 into tissue contact when the electrode 64 is thus positioned for surgery.

It is an advantage of the present invention that a bipolar electrosurgical apparatus is provided wherein the return electrode is urged into contact with tissue when the active electrode is positioned for surgery such that the return electrode reliably maintains tissue contact. It is a further advantage of the present invention that the return electrode can maintain tissue contact even in areas of irregular tissue topography. The present invention also provides a bipolar electrosurgical apparatus suitable for laparoscopic applications. It is a still further advantage of the present invention that a bipolar electrosurgical apparatus is provided which can function in a cut and in a coagulation mode for certain

applications and can receive signals from generator outlets commonly associated with monopolar instruments. Moreover, the present invention allows for simple adjustment of cutting depth during surgery substantially without the need to interrupt surgery. Further advantages will be apparent to those skilled in the art.

While the present invention has been described in relation to specific embodiments thereof, additional alternative embodiments apparent to those skilled in the art in view of the foregoing are intended to fall within the scope of the present invention as further defined by the claims set forth below.

<u>What Is Claimed Is</u>:

1. An electrosurgical instrument, comprising:

a support structure; and

first and second electrode means interconnected with said support structure for relative movement during surgery.

2. The instrument of Claim 1, further comprising:

biasing means interposed between said first and second means for urging said first means into contact with tissue when said second means is positioned for surgery.

3. The instrument of Claim 1 wherein said first means and said second means are dimensioned so as to allow insertion thereof through an access cannula for laparoscopic surgery.

4. The instrument of Claim 1 wherein said first means is longitudinally movable relative to said second means.

5. The instrument of Claim 1 wherein said first means is laterally movable relative to said second means.

6. The instrument of Claim 1, further comprising a signal source capable of providing at least a first signal sufficient for tissue cutting and a second signal sufficient for coagulation.

7. The instrument of Claim 1, wherein said first means includes a tissue contact surface, the surface defining a substantially planar interface with tissue during surgery, and said second means is transversely movable relative to the substantially planar interface.

8. The instrument of Claim 1, wherein said first means includes a first portion and a second portion, the first and second portions being separated by a space, and at least a portion of said second means is movable through said space.

9. The instrument of Claim 1, wherein each of said first and second means includes a tissue contact surface, the tissue contact surface of said first means having an area greater than that of the contact surface of said second means.

10. The instrument of Claim 1, wherein said first electrode means is pivotally mounted on said support structure.

11. The instrument of Claim 1, wherein said first electrode means includes a tissue contact surface and a flexible portion disposed between said tissue contact surface and said support structure, the flexible portion allowing movement of said tissue contact surface relative to said support structure.

12. An electrosurgical instrument, comprising:

first and second closely spaced electrode means for applying an electrical current to tissue; and

resilient means for orienting said first electrode means relative to said second electrode means wherein said first means maintains contact with said tissue when said second means is positioned for surgery.

13. The instrument of Claim 12, wherein said first means comprises a current return electrode and said second means comprises an electrode for cutting or coagulating tissue.

14. The instrument of Claim 12, wherein said first means is movable between a first position and a second position and said resilient means urges said first means towards said first position when said second means is positioned for surgery.

15. The instrument of Claim 12, wherein said resilient means comprises a spring operatively disposed between said first means and said second means.

16. The instrument of Claim 12, further comprising:

a longitudinal member to allow laparoscopic application of said first means and said second means.

17. The instrument of Claim 12, further comprising a signal source capable of providing at least a first signal sufficient for tissue cutting and a second signal sufficient for coagulation.

18. A method for use in electrosurgery comprising the steps of:

positioning an instrument including an active electrode and a current return electrode at a surgical site;

contacting said current return means with tissue; and

moving said active electrode relative to said current return means to position said active electrode for surgery.

19. The method of Claim 18, comprising the further step of:

providing a current to said active electrode sufficient for tissue coagulation.

20. The method of Claim 18, comprising the further steps of:

providing a current to said active electrode sufficient for tissue cutting.

21. The method of Claim 18, comprising the further step of:

varying a cutting depth of the instrument during surgery by moving the active electrode relative to the current return means.

22. A method for use in electrosurgery comprising the steps of:

inserting a current return means and an electrode for cutting or coagulating tissue through a cannula to a surgical site;

contacting said current return means with said tissue; and

moving said electrode for cutting or coagulating relative to said current return means to cut or coagulate said tissue.

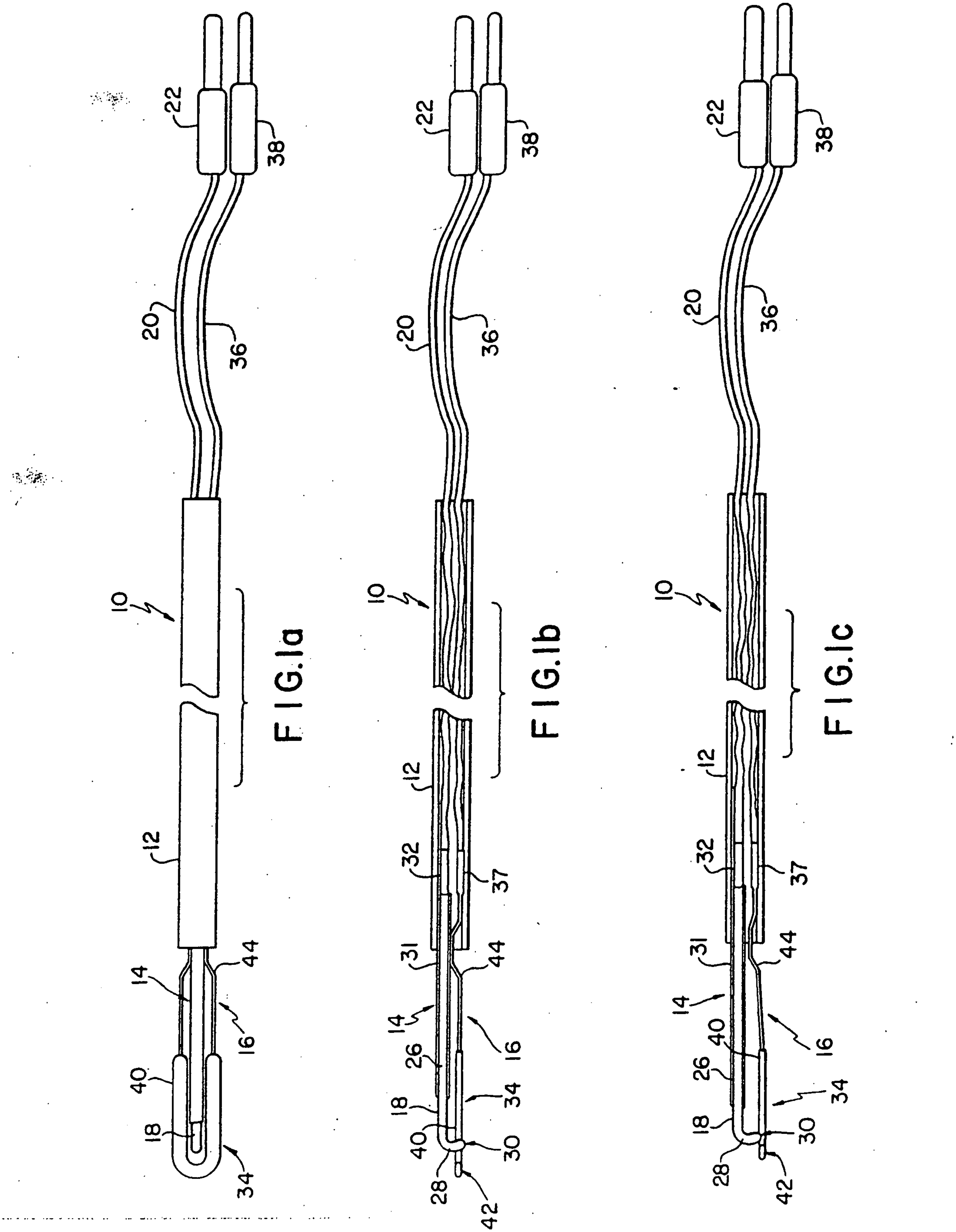


FIG.1a

FIG.1b

FIG.1c

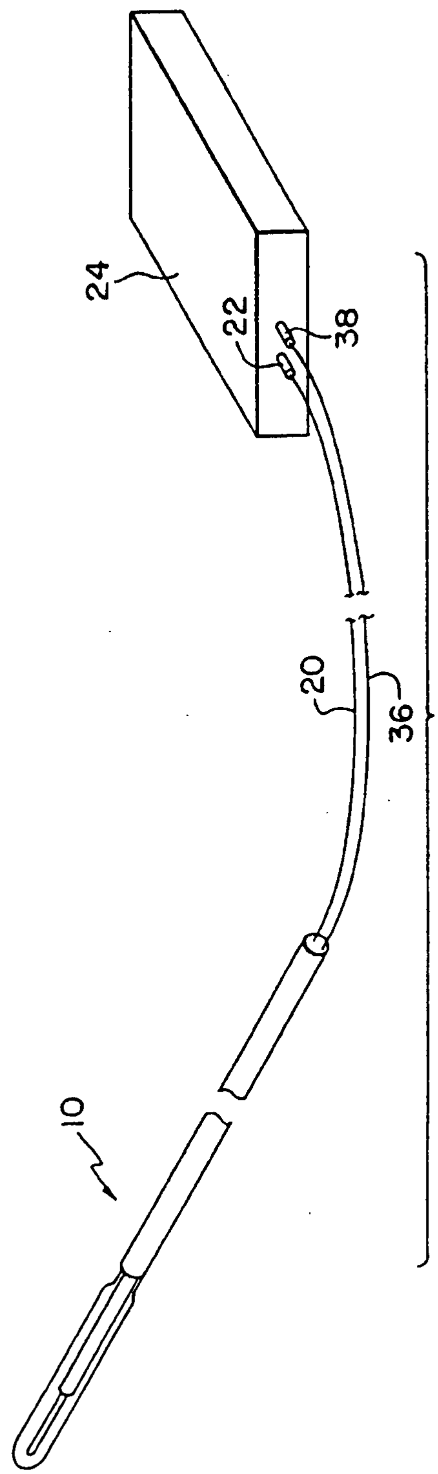


FIG.2

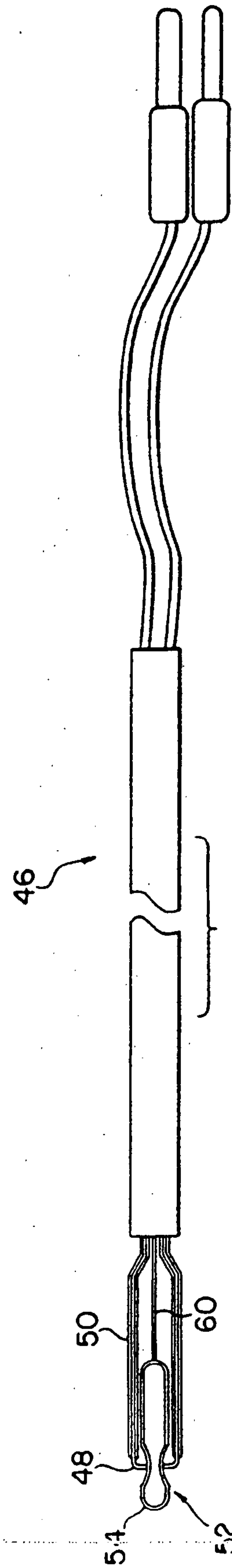


FIG.3a

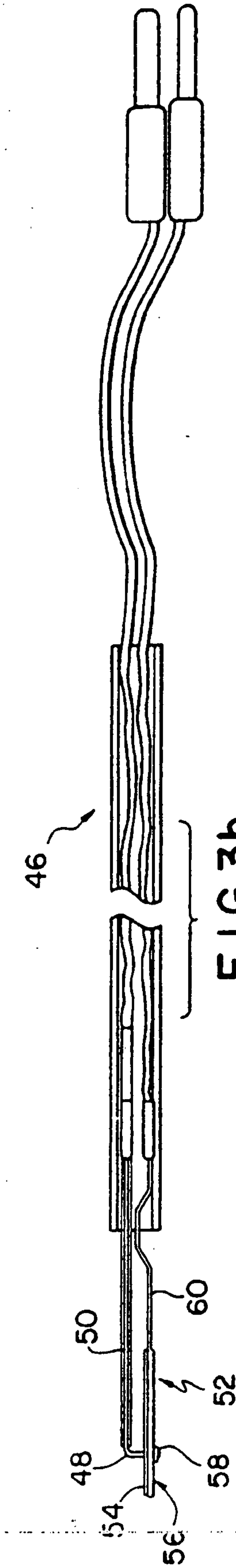


FIG.3b

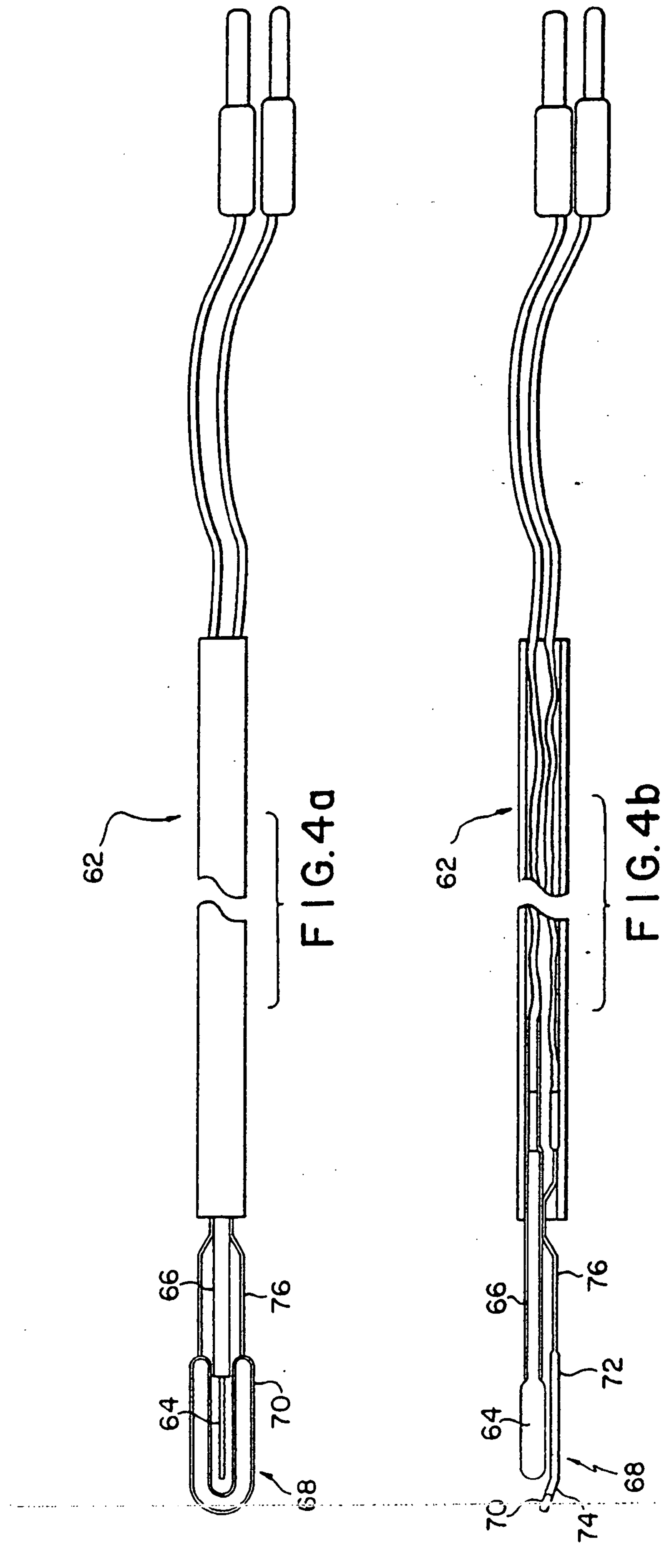


FIG.4a

FIG.4b

INTERNATIONAL SEARCH REPORT

PCT/US93/00443

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :A61B 17/39
US CL :606/48; 606/50
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 606/46; 606/51

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US,A, 2,056,377 (Wappler) 06 October 1936, See entire document.	1-22
X	US,A, 5,047,027 (Rydell) 10 September 1991, See entire document.	1-3,5,6, 9-22
X,P	US,A, 5,085,659 (Rydell) 04 February 1992, See entire document.	1,3,4,6,18,19,22

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be part of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
02 MARCH 1993	26 APR 1993

Name and mailing address of the ISA/US	Authorized officer
Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	LEE S. COHEN
Facsimile No. NOT APPLICABLE	Telephone No. (703) 308-2998